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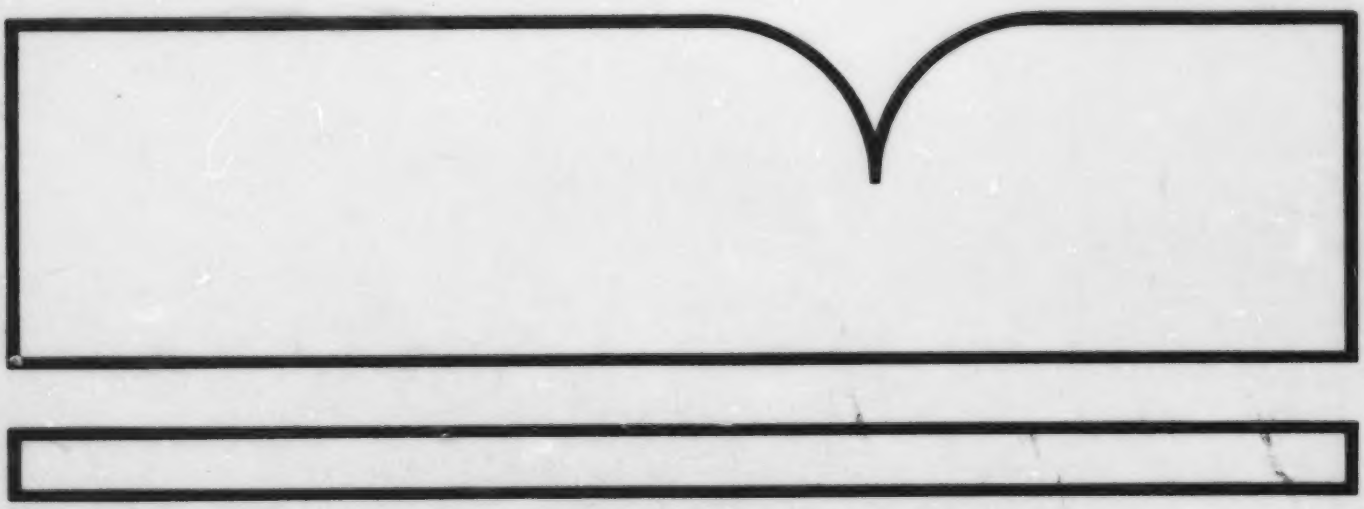

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16. ABSTRACT

Use of leaded fuel in a catalytic converter equipped vehicle (misfueling) adversely affects the ability of the catalyst to reduce undesirable emission levels through poisoning of the catalytic material. A quick reliable method of detecting habitual misfueling would be a valuable diagnostic tool for detecting lead poisoned catalysts. PLUMBTESMO is a lead sensitive test paper that according to its manufacturer's product leterature can be used to detect metallic lead. When applied to the inside surface of a tailpipe containing lead deposits, the originally white test paper develops red spots and streaks within a few minutes. This test can be applied to cold or hot tailpipes. The reaction appears to take place in less time when the tailpipe is hot. The I/M staff has conducted an evaluation of PLUMBTESMO on a sample of vehicles in the Ann Arbor area. This report describes that evaluation and its results.

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS	b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group
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Use of leaded fuel in a catalytic converter equipped vehicle (misfueling) adversely affects the ability of the catalyst to reduce undesirable emission levels through poisoning of the catalytic material. A quick reliable method of detecting habitual misfueling would be a valuable diagnostic tool for detecting lead poisoned catalysts. PLUMBTESMO is a lead sensitive test paper that according to its manufacturer's product literature can be used to detect metallic lead. When applied to the inside surface of a tailpipe containing lead deposits, the originally white test paper develops red spots and streaks within a few minutes. This test can be applied to cold or hot tailpipes. The reaction appears to take place in less time when the tailpipe is hot.

The I/M staff has conducted an evaluation of PLUMBTESMO on a sample of vehicles in the Ann Arbor area. A survey form (Attachment 1) requesting information concerning vehicle identification and fueling habits was completed by the vehicle owners prior to testing. Seventy vehicles were tested on two afternoons in July 1980. A PLUMBTESMO test paper was applied to each vehicle's tailpipe, allowed approximately five minutes to react, and then removed. A determination was made concerning color change as soon as the test paper was removed from the vehicle. The results of this survey are tabulated in Table 1.

The method of application of PLUMBTESMO is as follows:

1) The tailpipe was degreased by spraying a solvent (trichloroethylene) into the tailpipe. A common household pump sprayer was used. It was found necessary to degrease the tailpipe in order to wash away soot deposits which might mask the color change.

2) The PLUMBTESMO was moistened with distilled water. A common household sprayer was used for this also. Some care must be taken not to overly wet the test paper. Over wetting may wash the reactive chemical from the paper.

3) After allowing several seconds for the solvent to evaporate from the surface of the tailpipe the test paper was placed in the tailpipe and clamped in position with a spring-loaded wood clothespin.

4) After approximately 5 minutes the test paper was removed and the result was observed.

The PLUMBTESMO exhibited a definite color change when applied to vehicles whose owners reported regular use of leaded fuel. The vehicles certified for use on leaded fuel are assumed to simulate habitual misfueling of cars certified for use on unleaded fuel. In some cases a slight red color was observed on the test paper that was applied to vehicles required and claimed by their owners to use unleaded fuel. This coloration is attributable to contamination rather then to the presence of lead in the tailpipe. When plumbtesmo is applied to a tailpipe with a large quantity of lead deposits the reaction is vigorous. Some of the reacting chemicals were transferred to the wood clothespins and the technician's fingers and then transferred to the next test paper. Since approximately one-half of the vehicles in the

sample used leaded fuel the potential for contamination was large. To avoid this contamination careful handling of the test paper is required. This may be accomplished by discarding any clothespins used in a positive reaction or using a cleanable plastic clamp and using disposable wood sticks to apply and remove the test paper. Further, only vehicles requiring the use of unleaded fuel should be tested in any full scale program.

The test results show no errors of commission and three apparent errors of omission. Comments on the survey sheets indicate that these are three cases of casual misfueling. Vehicle owner comments reported on these survey sheets are:

1) Used leaded fuel for about the first 5,000 miles then used unleaded for 40,000 miles.

2) Used two tankfuls of leaded in 44,000 miles.

3) Occasional use of leaded over a year ago.

A research publication by General Motors research laboratories, "Evaluation of Methods for Detecting Lead in Vehicle Tailpipe Deposits" (GMR-3170) also reports excellent results using PLUMBTESMO. GM also reports, in this publication, positive tests after only one tankful of leaded gasoline.

Based on the experience gained in this evaluation the use of PLUMBTESMO appears to be a viable short test for detecting habitual misfueling. The test results can be obtained within five minutes when applied to a cold tailpipe. When the tailpipe is warm (as it would be in an I/M test lane) the test results can be obtained much quicker. Further testing will be required to evaluate the effectiveness of Plumbtesmo as an indicator of casual misfueling.

The lead-sensitive test paper PLUMBTESMO is distributed by Gallard-Schlesinger Chemical Manufacturing Corporation, Carle Place, NY. A box of 40 test papers (40x25mm) sells for $16.30. The product literature accompanying the test papers is reproduced at the end of this report (Attachment 2).

TABLE 1

TEST RESULTS

	Test Positive (Lead)	Test Negative (No Lead)
VEHICLES WITH "USE UNLEADED FUEL ONLY" LABELS AND OWNERS REPORTS:		
Unleaded Use Only	0	30
Leaded Use Often	1	0
Leaded Use Occasionally	1	1*
Don't Know	0	1
VEHICLES WITHOUT FUEL LABELS AND OWNERS REPORTS:		
Unleaded Use Only	0	4
Leaded Use Often	29	0
Leaded Use Occasionally	0	2*
Don't Know	1	0

* Errors of Omission

ATTACHMENT 1

In order to correlate the results of the parking lot survey to actual use of leaded and unleaded fuel, the following information is requested about your vehicle.

MODEL YEAR _____

MAKE (Pontiac, Buick, Ford, AMC, VW, etc.) _____

MODEL (Grand Prix, Skylark, Mustang, Pacer, Rabbit, etc.) _____

COLOR _____

LAST THREE NUMBERS OF LICENSE PLATE _____

HAS LEADED (REGULAR OR LEADED PREMIUM) FUEL BEEN USED IN THIS VEHICLE? YES NO DON'T KNOW

IF YES, OFTEN? YES NO

Thank you for your cooperation.

PLUMBTESMO

Test paper for the determination of lead

PLUMBTESMO determines metallic lead and lead salts on surfaces and in solutions.

Color reaction:

The test paper turns from light yellow → pink to dark red-violet.

Method of application:

a) for the determination of metallic lead

Moisten the test paper with distilled water and press firmly for two minutes against the degreased surface to be tested. Substantial quantities of lead result in an immediate reaction, whereas smaller amounts of lead will only show after several minutes. The result should be determined within 15 minutes. As little as 0.05 µg Pb can be detected.

b) for the determination of lead in solutions

The test paper is moistened with distilled water. - Lead in excess of 0.3 gm. per liter will not react with the dry paper. - The solution to be tested is applied to the moistened strip, or the already moistened strip is dipped into the solution to be tested. A red color indicates the presence of lead. The procedure permits the determination of lead in quantities of 0.1 gm. per liter or more.

Lead in quantities of 0.3 to 0.005 gm. per liter can be determined by dipping one end of a dry PLUMBTESMO strip into the solution to be tested. After the solution has wetted the upper portion of the strip, the appearance of a red border immediately above the level of the liquid indicates the presence of lead.

Concentrations of less than 0.005 gm. per liter are detected by evaporating a drop of the test solution on a clean glass slide. A red spot indicates the presence of copper, when a wetted test paper is pressed firmly against the glass slide.

Interference:

The following elements, when present in large quantities, interfere with the reaction: **tellurium, silver, cadmium, barium and strontium.** Large amounts of **nitrate-ions** reduce the sensitivity of PLUMBTESMO.

When the presence of interfering cations is suspected, they can be eliminated (except for barium and strontium) through the following procedure: apply a few drops of an aqueous solution of 20 mg. KCN/100 ml. water to the red spots on the test paper, and shake in a micro tube with an equal volume of 1.5 mg. dithizone in 100 ml. carbon tetrachloride. The green dithizone-carbon tetrachloride solution turns brownish-red in the presence of lead.

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ATTACHMENT 2